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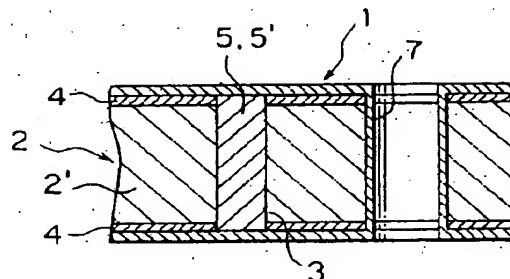
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(54) Printed circuit board

(57) A resistor (5) is provided in a conductor layer (4) by being electrically connected thereto so that a surface of the resistor (5) and that of the conductor layer (4) is included in one plane in the direction of the thickness of a printed board (2) with the conductor layer (4) provided in a base (2') for a printed circuit.

FIG. 1



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Fig. 4 is a vertical cross-sectional view showing a key section of a conventional type of the printed circuit board;

Fig. 5 is a vertical cross-sectional view showing a key section of another type of the printed circuit board described above;

Fig. 6 is a vertical cross-sectional view showing a key section of still another type of the printed circuit board as described above; and

Fig. 7 is a cross-sectional perspective view showing a multilayer printed circuit board.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In the embodiments according to the present invention shown in Figs. 1 to 3, the same reference numerals are assigned to the portions playing the same functions as those in the conventional types thereof described above, so that description thereof are omitted herein, and description is made mainly for different portions.

In Embodiment 1 according to the present invention as shown in Figs. 1 and 2, a printed board 2 in which a conductor layer 4 to function as a land is provided only on the surface of a base 2' for the printed circuit is used, a hole for a resistor 5 penetrating the conductor layer 4 and the base 2' for the printed circuit in the direction of the thickness thereof is provided, carbon or a carbon-based resistor substance 5' is embedded into this hole 3 by using any of a press-fitting process, a sucking process, injecting process, or a combination thereof, the resistor substance is cured, the residual resistor substance protruding from the surface of the conductor layer 4 is cut off or removed by buffing so that the surface of the resistor and that of the conductor layer 4 are included in one plane surface, to form the resistor substance into a resistor, and thus the printed circuit board 1 as shown in Fig. 1 is formed by means of the subtractive process or the additive process conventionally used. It should be noted that the printed circuit board 1 may be formed by means of the subtractive process or the additive process by using a base 2' for the printed circuit without a conductor layer 4 to be provided therein in place of the printed board 2.

In the printed circuit board described above, there is electrical continuity between the resistor 5 and the conductor layer 4, and the circuit is formed according to the circuit pattern.

Also, to obtain a desired resistance value of the resistor 5, any diameter of this hole 3 should be selected as necessary, and this hole 3 is formed by means of drilling, press working, or laser beam machining, and the shape thereof is not necessarily required to be a circle, and may be a triangle, or a square or any of other shapes, and furthermore, a desired resistance value may be obtained by selecting a certain material for the resistor substance 5' as necessary.

As described above, the resistor 5 having a desired resistance value in the direction of the thickness of the

printed circuit board 2 is included in the printed board 2 so that the surface of the resistor does not come out of the surface of the printed board 2, and a surface of the printed circuit board 2 does not have any specific space where placement of any component is inhibited such as so-called the mounting-inhibited area, nor a bottom surface of IC or the like or any other specific space as that in the conventional technology, so that a resistor can be mounted in an area in which placement of component has been impossible in the conventional technology, and at the same time other components can be superimposed on and attached to a top section of mounted resistor 5, which makes it possible to build-up components, and for this reason size reduction and cost reduction can be achieved by improving the board density. Furthermore, soldering to a mounted resistor 5 is not required, so that pollution due to lead can be reduced.

In Embodiment 2, a printed circuit board is formed by using the multilayer printed board 20 shown in Fig. 7 in place of the printed board used in Embodiment 1, and subjecting this multilayer printed board 20 to the same processing as that in Embodiment 1, then embedding the resistor thereinto. In the board as described above, a jumper circuit across circuits can easily be formed, which makes an occupied area of the circuit smaller.

In Embodiment 3, as shown in Fig. 3, a plurality of the printed circuit board 1 according to Embodiment 1 are laminated through insulation layers 15. A multilayer printed circuit board 1' is formed by using an epoxy-based material having an insulating capability as an insulation layer 15, and sandwiching this member between the printed circuit boards 1, and heat-welding them to each other. An epoxy-based material may not necessarily be used for this insulation layer 15, and other appropriate member having an insulating capability may be used in place thereof. In a case where conductor layers in the printed circuit boards in the multilayer printed circuit board 1' are expected to be electrically connected to each other, a hole is made in the portion and through-hole plating 7 is applied thereto. In the circuit board, a three-dimensional circuits can be formed, which makes an occupied area thereof smaller. It should be noted that, the printed circuit board in Embodiment 2 may be used as a multilayer printed circuit board in place of the printed circuit board in Embodiment 1. Also resistors 5a and 5b may be provided, like in Embodiment 1, between each layer of a plurality sheets of printed circuit boards, or between desired several sheets of the printed circuit boards 1_L and 1_M in this multilayer printed circuit board. Then the printed circuit board 1 is formed by the subtractive process or an additive process.

The present invention is as described above, and in the invention as described in Claim 1, a resistor is provided in the conductor layer by being electrically connected thereto so that the surface of the resistor and that of the conductor layer in the direction of the thickness of the printed board with a conductor layer provided in a base for the printed circuit are included in one plane, which makes it possible to achieve high-board density,

FIG. 1

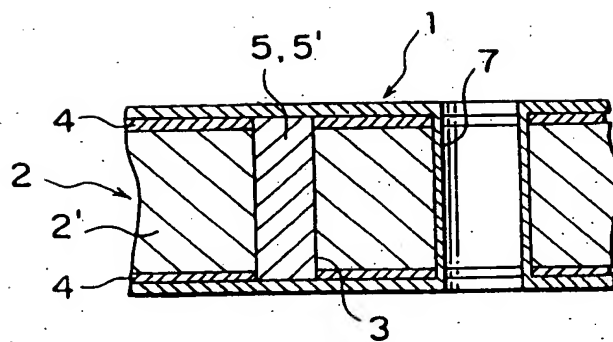


FIG. 2

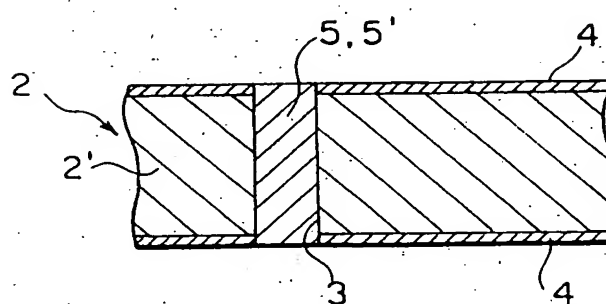
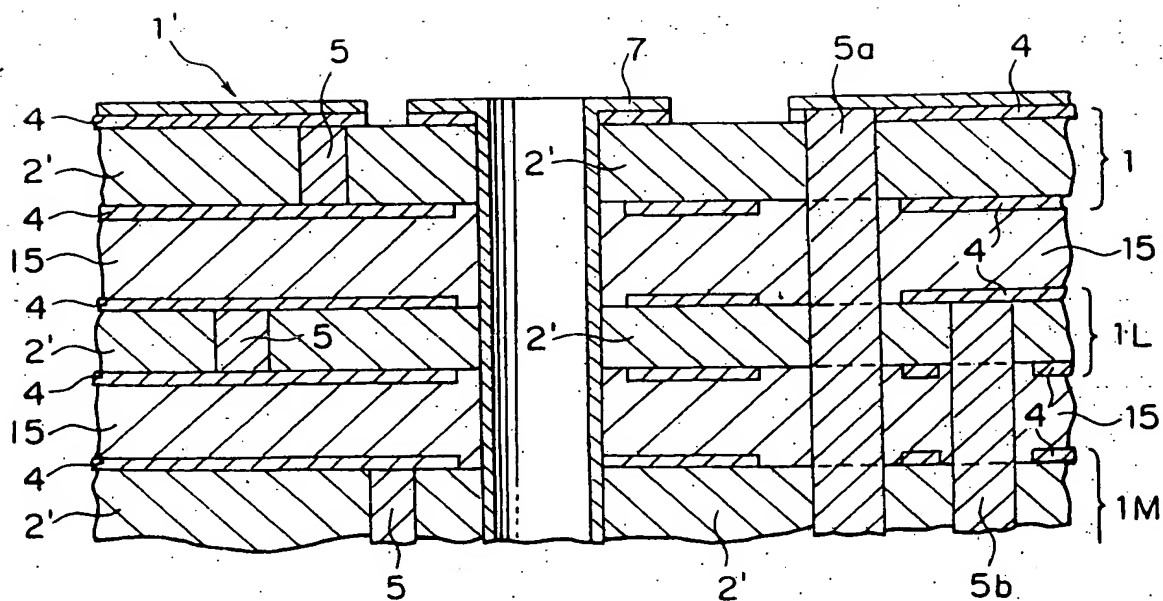


FIG. 3





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EUROPEAN SEARCH REPORT

Application Number
EP 95 11 9116

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|---------------------------------------------------------|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.6) |
| X | EP-A-0 574 206 (NIPPON CMK CORP.) * the whole document * | 1-4,6 | H05K1/16 |
| X | EP-A-0 491 543 (HUGHES AIRCRAFT COMPANY) * the whole document * | 1-5 | |
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| X | PATENT ABSTRACTS OF JAPAN vol. 15 no. 4 (E-1020) ,8 January 1991 & JP-A-02 260593 (MITSUMI ELECTRIC CO) 23 October 1990, * abstract * | 1,6 | |
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| The present search report has been drawn up for all claims | | | |
| Place of search THE HAGUE | | Date of completion of the search 22 March 1996 | Examiner Mes, L |
| CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document | | | |